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Trends Between 2000 and 2005 in SNF Rates of Community Discharge and Rehospitalization

A study conducted by staff from
the Division of Health Care Policy and Research
University of Colorado at Denver and Health Sciences Center
for the Medicare Payment Advisory Commission

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1 Introduction

Medicare beneficiaries experience approximately 2.5 million admissions per year to post-acute skilled care in nearly 17,900 Medicare-certified skilled nursing facilities (SNFs), requiring Medicare expenditures of $18.5 billion[1-4]. Prior research conducted by the UCDHSC found that risk-adjusted facility rehospitalization rates for Medicare SNF residents in the first 100 days after SNF admission increased from 11.8% to 17.0% between calendar year 2000 and 2004[5]. These rates were based on hospitalizations for five conditions—heart failure, respiratory infection, urinary tract infection, sepsis, and electrolyte imbalance—which have been considered among the leading causes of potentially avoidable hospitalizations[6-8]. A decrease in risk-adjusted facility community discharge rates occurring within 30 days of admission from 27.6% to 23.9% occurred between calendar year 2000 and 2004, but risk-adjusted 100-day community discharge decreased only marginally between 2000 and 2004[5]. These findings suggested a trend of SNF patients returning to the community after longer SNF stays, but no change in the rate at which Medicare SNF patients ultimately returned home.

Further analysis of factors associated with measures of SNF community discharge and rehospitalization for potentially avoidable causes showed that high quality based on these measures was strongly associated with whether a facility was hospital-based and higher licensed staffing levels, as well as geographic factors[9]. The temporal decline in community discharge rates appeared to be explained largely by these factors, particularly the loss of hospital-based and higher staffed facilities. The temporal increase in rehospitalization rates appeared to be partially explained by loss of hospital-based and higher staffed facilities and changes in these factors.

The purpose of this study was to update the previous analysis with data from 2005, to determine whether these temporal trends continued. Additionally, the study examined whether the previously identified factors continued to be associated with these two SNF quality measures over time.

2 Methods

2.1 Data sources and sample

The national DataPRO SNF Stay File, containing information on Medicare-covered SNF stays linked with the preceding qualifying hospitalization and any rehospitalization was used in all analyses. This file contains information from Medicare claims, the MDS, and the Online Survey Certification and Reporting (OSCAR) system; file documentation is available elsewhere[5;10]. OSCAR-reported staffing levels for 2000 through 2005 were used to supplement the DataPRO SNF Stay File for these analyses. The OSCAR staffing data editing rules proposed by Abt Associates[11] were applied. These sources were combined at the facility level to create a single analysis file. Analysis of the stability and variability of the risk-adjusted rates indicated that a minimum sample of 25 or more stays (excluding deaths) over one year was required for estimates to be sufficiently stable[5]. The analysis file was therefore restricted to only those SNFs with at least 25 stays (excluding deaths) with known outcome for any year between 2000 and 2005. This analysis file was an update to the file used in the previous report[11] to MedPAC, and slightly different cases were included even for the common years from 2000 to 2005.

2.2 Measures

2.2.1 Facility characteristics

Resident characteristics were aggregated to the facility level to obtain facility case mix measures. The specific resident characteristics aggregated were the set of measures used previously for resident-level risk adjustment[5]. These included presence of advance directives, the Barthel Index (a measure of functional independence, ranging from 0 most dependent to 90 most independent)*, the Cognitive Performance Scale (a measure of cognitive impairment, ranging from 0 least impaired to 6 most impaired), selected MDS items, a weighted comorbidity index[5], selected comorbid conditions (primary or secondary diagnoses from the qualifying hospitalization), and length of stay of the qualifying hospitalization. OSCAR-reported staffing levels for RN, licensed nursing (defined as RNs, LPNs, DONs, and nurses with administrative duties), and CNA hours per resident-day were also examined. Measures of facility characteristics included hospital-based/freestanding, urban/rural, ownership, and region.

2.2.2 Outcome measures

Two outcome measures were investigated: observed rate of community discharge and observed rate of rehospitalization for any of the following five conditions: heart failure, electrolyte imbalance, respiratory infection, sepsis, and UTI. Both measures were assessed at 30 days and 100 days after SNF admission, and excluded residents who died in the SNF before 30 days or 100 days, respectively.

Community discharge was defined as direct discharge from the SNF to home or assisted living. However, if a resident was discharged to community but then hospitalized within one day, the stay was reclassified as a rehospitalization and not a community discharge.

The rehospitalization measure was limited to hospitalizations with an ICD-9-CM code for heart failure, electrolyte imbalance, respiratory infection, sepsis, or UTI - conditions for which rehospitalization may be potentially avoidable. Rehospitalization was defined as an admission to an acute care or critical access hospital. Any such hospitalization that occurred within one day of SNF discharge (regardless of discharge location) also was considered a rehospitalization.

2.3 Univariable analyses

2.3.1 Changes in outcomes over time

For each of the four outcomes (community discharge and rehospitalization within 30 and within 100 days of SNF admission), simple descriptive statistics were computed by year at the facility level.

For each outcome, resident-level risk-adjusted scores reflecting the resident's probability of experiencing the outcome were calculated based on the risk adjustment models. Facility-level scores

* Climbing stairs is not available on the MDS resulting in a 90 point scale in contrast to the original 100 point Barthel Index.

for each outcome were then calculated by averaging the resident-level scores for all residents within the facility. *Risk-adjusted* facility-level scores were calculated using the methodology for calculating quality measures for Nursing Home Compare[12]. The risk-adjusted score is adjusted for the specific risk for that measure in the nursing facility, and can be thought of as an estimate of what the facility's score would be if the facility had residents with average risk. The facility-level risk-adjusted score is calculated using the facility observed outcome rate, the facility expected outcome rate (the facility-level score calculated by averaging the resident scores), and the national average resident observed outcome rate.

Both 30- and 100-day outcome measures for community discharge and rehospitalization were considered in describing temporal rate changes, calculating unadjusted facility observed rates and facility-level adjusted rates for all years from 2000 to 2005. The remainder of the analysis focused on comparison of 2000 and 2005 observed rates within 100 days for both community discharge and rehospitalization since it was determined that the 100-day measures were more stable as quality measures.

2.3.2 Differences between facilities present at different time points

Initial results suggested that facilities that were present for the both analysis periods (2000 and 2005) had different outcome rates than facilities that were present only at 2000 or only at 2005. "Presence" required at least 25 observations (excluding deaths) for which the outcome was known (i.e., not missing). A facility might be "not present" if it had fewer than 25 stays or if it was not in business at all. Unadjusted comparisons of facility characteristics were made with the group of facilities present at 2000 regardless of status at 2005, and with the group of facilities present at 2005 regardless of status at 2000.

2.4 Multivariable analyses

2.4.1 Influence of staffing, facility characteristics, acute length of stay, and geographic region

The data were restricted to only year 2000 and 2005, and pooled so that each facility-year was a separate record. A dichotomous variable ("time") indicated whether the observation was from 2000 or 2005. Two dummy variables were constructed indicating whether the facility was present in the data file in 2000 but not in 2005 ("2000 only") or if the facility was present in the data file in 2005 but not in 2000 ("2005 only"). The reference group was facilities present at both time points. "Presence" required at least 25 observations (excluding deaths) for which the outcome was known (i.e., not missing).

A series of OLS regressions were fit to assess the impact of various facility measures on outcome rates. The first regression model included only the time variable as an independent variable. The second model included time as well as the two dummy variables. The third model included time, the two dummy variables, and a set of case mix variables. Each subsequent model then added one variable (in some cases a set of variables) to the third model. The procedure is shown schematically below:

Step 1: observed rate = f(time)
Step 2: observed rate = f(time, 2000 only indicator, 2005 only indicator)
Step 3: observed rate = f(time, 2000 only indicator, 2005 only indicator, case mix variables)
Step 4: observed rate = f(time, 2000 only indicator, 2005 only indicator, case mix, hospital LOS)
Step 5: observed rate = f(time, 2000 only indicator, 2005 only indicator, case mix, region)
etc.

The model adjusted R^2, the estimated coefficient of the variable being tested, the estimated coefficient of time, and the estimated coefficient of the two dummy variables were assessed for each model. If the coefficient of time decreased as additional variables were added to the model, then the effect of time could be at least partially explained by the additional variable. Similarly, changes in the coefficients of the dummy variables indicated the influence of the added variable. Variables tested in this manner included: hospital length of stay, region, staffing levels, hospital-based versus freestanding, urban versus rural, and ownership.

2.4.2 Final models with and without staffing variables

Two final models were fit using all tested variables together, first excluding the OSCAR-reported staffing for licensed nursing and CNA. The magnitude of the coefficient of a facility type variable can be influenced by variables associated with facility type, especially staffing levels. For example, hospital-based facilities generally have significantly higher staffing levels than freestanding SNFs. If the magnitude of the coefficient of hospital-based facilities drops significantly in the second model including the staffing variables, much of the effect of hospital-based facilities can be explained by differences in staffing levels. Because RNs represent a significant portion of licensed nursing staff, the RN and licensed nursing staff variables are highly correlated (r = .80). Thus, we included only licensed nursing in the final model.

3 Results

3.1 Change in facility outcomes from 2000 to 2005

Unadjusted facility observed rates and facility-level adjusted rates of the four outcome measures from 2000 through 2005 are presented in Table 1. The average rate, and the difference in average rate between years are shown for each outcome. In addition, the difference in rates between 2000 and 2005 is shown.

Observed rates of community discharge within 30 days declined over time, while rates of community discharge within 100 days were more stable. Between 2000 and 2005, the average rate of community discharge within 30 days decreased by 1.6 percentage points, while the average rate of community discharge within 100 days increased by 0.2 percentage points.

In contrast, observed rates of rehospitalization within 30 days and within 100 days increased over time. Between 2000 and 2005, the average rate of rehospitalization within 30 days increased by 2.6 percentage points, and the average rate of rehospitalization within 100 days increased by 3.3 percentage points.

Adjusted rates followed similar trends to corresponding observed rates. Between 2000 and 2005, the average rate of community discharge within 30 days decreased by 3.2 percentage points, while the average rate of community discharge within 100 days decreased by less than 0.1 percentage points. Between 2000 and 2005, the average rate of rehospitalization within 30 days increased by 4.6 percentage points, and the average rate of rehospitalization within 100 days increased by 6.1 percentage points.

3.2 Changes in case mix and facility characteristics from 2000 to 2005

A comparison of all independent variables between 2000 and 2005 is shown in Table 2. The measures include case mix (e.g., average resident age, or percent of residents with DNR orders), staffing levels, and facility characteristics.

In aggregate, changes in resident case mix between 2000 and 2005 appear somewhat modest. The larger changes include increases in the percent of residents with DNR orders, receiving parenteral IV feeding, with genitourinary conditions, with hypertension, or with musculoskeletal disorders, and decreases in the percent of resident being tube-fed, or with fractures. Average length of stay of residents' prior qualifying hospital stay declined by more than half a day, from 9.3 to 8.6 days. Average staffing levels dropped for RN and licensed nursing, and increased slightly for CNAs. There were small shifts in geographic distribution, with the South and Midwest experiencing slight increases and the Northeast and West experiencing slight decreases. The percentage of SNFs that were hospital-based dropped from 13.3% to 7.8%, and urban facilities decreased from 71.2% to 68.4%. The percentage of SNFs that were for-profit increased modestly.

3.3 Community discharge within 100 days

Table 3 presents results from the sequence of regression models for community discharge within 100 days. In step 1, the only variable in the model was the time variable, indicating either 2000 or 2005. The coefficient of time was 0.00203, which is consistent with the earlier finding that observed rates of community discharge increased 0.2 percentage points between 2000 and 2005.

In step 2, the two dummy variables 2000 only and 2005 only were entered, and the model adjusted R^2 increased slightly. The coefficient of the 2000 only indicator was 0.1526, indicating that facilities present only in 2000 had community discharge rates in 2000 that were 15.3 percentage points higher than facilities present at both time points. The coefficient of the 2005 only indicator was -0.0814, indicating that facilities present in 2005 only had community discharge rates in 2005 that were 8.1 percentage points lower than facilities present at both time points. That the coefficient of time changed from 0.0020 to 0.0319 indicates that the rate of community discharge actually increased by 3.2 percentage points for those facilities present at both time points. This rate increase was not apparent from the observed rates pooling all facilities since those facilities present only in 2000 and those facilities present only in 2005 pulled the rates from the opposite directions.

In step 3, a set of facility case mix variables were entered, vastly increasing the model adjusted R^2 as expected. Controlling for facility case mix significantly affected the coefficients of the other

three variables. The coefficients for both 2000 only and 2005 only decreased substantially in magnitude, indicating that there were substantial differences in case mix in these two groups compared to those facilities present at both time points. The coefficient of time became much smaller, indicating that once differences in facility case mix are accounted for, the community discharge rates for facilities present at both time points only modestly increased.

The addition of the case mix variables substantially increased the model R^2 (R^2=0.595 at this step). This is not surprising given that the resident-level model on which this model is based had a c-statistic of 0.78 [5]. This is better than patient-level models used for comparisons among hospitals of coronary artery bypass graft mortality for example [13]. The model controls for factors such as cognitive and functional status as well as comorbidity. The models do not include an indicator of whether SNF admissions previously resided in a nursing home because the secondary data sources did not include a reliable indicator of permanent residence in a nursing facility. However, the risk factors control for factors that are associated with nursing home residence, and explain a large portion of the variance in community discharge.

In step 4, acute length of stay was entered, which had a negligible effect on the model adjusted R^2. The small coefficient and minimal impact on the other estimates suggests that acute length of stay does not explain much of the variance in community discharge rates after controlling for case mix.

In step 5, three dummy variables for Northeast, Midwest, and South region were entered, leaving out the Western region as the reference group (it had the highest community discharge rate). Adding region improved the model adjusted R^2 and showed that after adjusting for case mix, SNFs in the rest of the country had community discharge rates 4.3 to 8.2 percentage points lower than SNFs in the West.

In step 6, hospital-based versus freestanding was entered, with a significant increase in model adjusted R^2 compared to the Step 3 model. Furthermore, the coefficient was 0.140, indicating that even after adjusting for case mix, hospital-based SNFs had community discharge rates that were 14.0 percentage points higher than freestanding SNFs. The coefficient of the 2000 only indicator dropped significantly, suggesting that the differences in rates for facilities present in 2000 only versus both time points were associated with differences in the proportion of facilities that were hospital-based.

Steps 7 and 8 tested the impact of ownership (for-profit versus not for-profit, and government versus not for-profit), and urban versus rural setting. On average, for-profit SNFs had community discharge rates 1.5 percentage points lower than not for-profit SNFs; however, after simultaneously controlling for hospital-based, there was no difference between for-profit and non-profit facilities (Table 4A). Urban facilities had community discharge rates 3.1 percentage points higher than those in rural areas.

Staffing levels were entered in steps 9 through 11, separately for RN hours/resident-day, licensed nursing hours/resident-day, and CNA hours/resident-day. Compared to the Step 3 model, RN and licensed nursing staffing levels had substantial effects on the model R^2; CNA staffing levels had a smaller effect. On average, for every one-hour increase in RN hours/resident-day, the community

discharge rate increased by 5.7 percentage points; for licensed nursing the average increase was almost 4 percentage points; for CNA the average increase was 1.4 percentage points. The magnitude of the coefficient of the 2000 only indicator dropped substantially with the addition of RN or licensed nursing staffing levels, suggesting that a large part of the differences in rates for facilities present in 2000 only versus both time points was associated with large differences in licensed staffing. In step 12, all three staffing level variables were entered together, with consistent results.

The final community discharge models are shown in Tables 4A (without staffing variables) and 4B (with staffing variables). The model adjusted R^2s were about 0.64. The coefficient of the 2000 only indicator was not significant in the model with staffing level and hospital-based variables in the model, indicating that most likely hospital-based and staffing accounted for this effect. The coefficients of the 2005 only indicator were -0.0361 and -0.0395, respectively, smaller in magnitude than initially. This suggests that a big portion of the differences between facilities present in 2005 only versus at both time points can be explained by differences in case mix and other facility measures.

Hospital-based facilities had community discharge rates that were 14.4 percentage points higher than freestanding facilities in the model without staffing variables; however, the hospital-based coefficient was significantly smaller in the second model with staffing variables. This suggests that the rate difference in the first model between hospital-based and freestanding facilities were partially due to differences in staffing levels.

3.4 Rehospitalization within 100 days

Table 5 presents results from the sequence of regression model fitting for rehospitalization within 100 days. With only the time variable (indicating 2000 or 2005) in the model, the adjusted R^2 was low as expected. The coefficient of time was 0.03326, consistent with the earlier finding that observed rates of rehospitalization increased by 3.33 percentage points between 2000 and 2005.

In step 2, the two dummy variables 2000 only and 2005 only were entered, and the model adjusted R^2 increased slightly. The coefficient of the 2000 only indicator was -0.0420, indicating that facilities present only in 2000 had rehospitalization rates in 2000 that were 4.2 percentage points lower than facilities present at both time points. The coefficient of the 2005 only indicator was -0.0085, indicating that facilities present in 2005 only had rehospitalization rates in 2005 that were 0.9 percentage points lower than facilities present at both time points. The rate increase of rehospitalization were actually less severe for those facilities present at both time points since those facilities present only in 2000 had much lower rates than those facilities present only in 2005.

In step 3, facility case mix variables were entered, vastly increasing the model adjusted R^2 as expected. Controlling for case mix substantially affected the coefficients of the other three variables. The coefficients for both the 2000 only indicator and the 2005 only indicator decreased substantially in magnitude, indicating that there were substantial differences in case mix between facilities in these two groups and those facilities present at both time points. The coefficient of time dropped to 0.0214, indicating that even after accounting for differences in facility case mix, the rehospitalization rates for facilities present at both time points increased by more than 2 percentage points.

In step 4, acute length of stay was entered, but had minimal effect on model adjusted R^2 or the other estimates. This suggests that acute length of stay does not explain variance in rehospitalization rates after adjusting for case mix.

In step 5, three dummy variables for Northeast, Midwest, and South region were entered, leaving out the Western region as the reference group (it had the lowest rehospitalization rate). Adding region improved the model adjusted R^2 from step 3 and showed that after adjusting for case mix, SNFs in the rest of the country had rehospitalization rates 1.7 to 2.7 percentage points higher than SNFs in the West.

In step 6, hospital-based versus freestanding was entered, with a significant increase in model adjusted R^2 compared to the Step 3 model. Furthermore, the coefficient was -0.056, indicating that even after adjusting for case mix, hospital-based SNFs had rehospitalization rates that were 5.6 percentage points lower than freestanding SNFs. The coefficient of the 2000 only indicator dropped substantially, suggesting that the differences in rates for facilities present in 2000 only versus both time points were associated with differences in the proportion of facilities that were hospital-based.

Steps 7 and 8 tested the impact of ownership (for-profit versus not for-profit, and government versus not for-profit), and urban versus rural setting. On average, for-profit facilities had a 2.1 percentage points higher rate of rehospitalization than non-profit facilities; urban versus rural had non-significant effect on the model.

Staffing levels were entered in steps 9 through 11, separately for RN hours/resident-day, licensed nursing hours/resident-day, and CNA hours/resident-day. Compared to the Step 3 model, RN and licensed nursing staffing levels had significant effects on the model adjusted R^2; CNA staffing levels had a smaller effect. On average, for every one hour increase in RN hours/resident-day, the rehospitalization rate decreased by almost 2 percentage points; for licensed nursing the average decrease was 1.2 percentage point per hour of time; for CNA the average decrease was minimal (0.4 percentage points). The magnitude of the coefficient of the 2000 only indicator dropped by more than half with the addition of RN and licensed nursing levels, suggesting that a large part of the differences in rates for facilities present in 2000 only versus both time points was associated with differences in licensed staffing. In step 12, all three staffing level variables were entered together, with consistent results.

The final rehospitalization models are shown in Tables 6A (without staffing variables) and 6B (with staffing variables). The model adjusted R^2s were both about 0.54. The coefficients of time were about 0.022, about a third lower in magnitude than initially, suggesting that some of the increase in observed rehospitalization rates can be explained by variables in the model. That it remained significant indicates that there was still an independent effect of time. The coefficients of 2000 only were -0.0093 and –0.0059, respectively, substantially lower than initially, indicating that other variables in the model (most likely hospital-based and staffing) accounted for this effect. The coefficients of 2005 only were -0.0025 and –0.0030, smaller in magnitude than initially, and approximately the same as when only case mix was in the model. This suggests that some, but not

all, of the differences between facilities present at 2005 only versus at both time points can be explained by differences in case mix and possibly facility characteristics.

Hospital-based facilities had rehospitalization rates that were 4.6 percentage points lower than freestanding facilities in the model without staffing variable; however, the hospital-based coefficient was significantly smaller in the second model with staffing variables. This suggests that the rate difference in the first model between hospital-based and freestanding facilities were partially due to differences in staffing levels.

4 Conclusions

Rehospitalization rates at 30 and 100 days continued to increase from 2004 to 2005 in terms of both observed and risk-adjusted rates. Community Discharge rates improved at both 30 and 100 days between 2004 and 2005, with respect to both observed and risk-adjusted rates. In fact, 100-day community discharge rates were comparable between 2000 and 2005 after risk adjustment. The number and percentage of hospital-based facilities continued to decline from 2004 by about 1% such that only 7.8 % of facilities were hospital-based in 2005, in contrast to 13.3 % of facilities in CY2000[9]. While staffing levels did not continue to decline between 2004 and 2005, the licensed and RN staffing levels in 2005 remained well below the levels in CY2000. The temporal decline in rehospitalization rates was again partially explained by the loss of hospital-based and higher staffed facilities, and changes in licensed staffing levels. Community discharge rates were higher in facilities with higher licensed staff levels and in hospital-based facilities. For-profit facilities had slightly higher rehospitalization rates and comparable community discharge rates after controlling for case mix and facility characteristics.

Community discharge and potentially avoidable rehospitalization rates are SNF outcomes that are gaining traction as performance measures. With 78% of SNF patients receiving rehabilitation services[14] and 43% expected to be discharged within 90 days[5], discharge is clearly a major goal of SNF care. Community discharge has been widely used in studies of rehabilitation and has been shown to be related to process quality measures in SNFs[15-18]. For many other SNF patients, the goal is to stabilize, monitor, and prevent complications following acute medical or surgical care, avoiding the need for rehospitalization. Hospitalization has been used to measure quality of ambulatory care using ambulatory care sensitive conditions[19-21], as a publicly reported measure for home health care[22-24], and will be used in the CMS nursing home value based purchasing demonstration[25]. Thus, community discharge and rehospitalization for potentially avoidable causes appear to be robust performance measures for Medicare SNFs that should continue to be monitored.

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TABLES

Table 1: Change in facility rates of proposed outcome measures for 2000 - 2005 SNF admissions[1]

	2000	2001	2002	2003	2004	2005	Total
Observed Rates							
Community Discharge							
30 days	23.66%	22.81%	22.30%	21.79%	21.87%	22.05%	
		-0.85	-0.51	-0.51	0.08	0.18	-1.61
100 days	31.17%	30.52%	30.45%	30.44%	30.95%	31.37%	
		-0.65	-0.07	-0.01	0.51	0.42	0.20
Rehospitalized for Any of Five Conditions							
30 days	11.35%	12.19%	12.64%	13.27%	13.46%	13.93%	
		0.85	0.45	0.63	0.20	0.46	2.58
100 days	14.69%	15.79%	16.40%	17.23%	17.55%	18.02%	
		1.09	0.61	0.84	0.31	0.47	3.33
Adjusted Rates							
Community Discharge							
30 days	27.58%	25.92%	24.97%	23.89%	23.86%	24.40%	
		-1.66	-0.95	-1.08	-0.03	0.54	-3.18
100 days	33.74%	32.47%	32.36%	32.18%	32.82%	33.73%	
		-1.27	-0.11	-0.18	-0.64	0.91	-0.01
Rehospitalized for Any of Five Conditions							
30 days	9.51%	10.98%	11.89%	13.04%	13.40%	14.11%	
		1.47	0.92	1.14	0.36	0.71	4.60
100 days	11.70%	13.63%	14.92%	16.48%	17.12%	17.83%	
		1.92	1.29	1.57	0.63	0.72	6.13

[1] Table entries show the facility rate of interest on the top row, change from previous year in the bottom row.

Table 2: Comparison of mean facility measures between 2000 and 2005

	2000 (n=12,206)[1]		2005 (n=13,491)[2]	
	Mean	(Stdev)	Mean	(Stdev)
Case mix indicators[3]				
Age (years)	80.39	(3.3)	79.58	(1.1)
DNR orders	38.45%	(22.9)	40.76%	(22.0)
Do not hospitalize orders	1.85%	(6.1)	1.68%	(5.0)
Barthel Index (0-90)[4]	36.70	(9.5)	36.29	(8.586)
Cognitive Performance Scale (0-6)[5]	2.02	(0.7)	1.92	(0.7)
Bowel incontinence scale (1-4) (MDS item H1a)[5]	1.37	(0.7)	1.33	(0.7)
Indwelling catheter (MDS item H3d)	22.06%	(11.3)	22.77%	(11.6)
Feeding tube (MDS item K5b)	9.40%	(8.7)	6.90%	(7.0)
Parenteral/IV feeding (MDS item K5a)	6.94%	(12.6)	11.41%	(16.3)
Pressure ulcer (MDS item M2a, any stage)	23.36%	(11.4)	22.72%	(10.9)
Rehabilitation RUG	76.25%	(17.2)	78.39%	(16.6)
Community discharge comorbidity index (-3.5 to 3.3)	-0.48	(0.1)	-0.49	(0.1)
Rehospitalization comorbidity index (-3.3 to 3.1)	0.38	(0.1)	0.40	(0.1)
Cardiac arrhythmia	25.89%	(7.5)	27.83%	(7.8)
COPD	22.53%	(7.7)	24.16%	(7.6)
Dementia	24.01%	(11.2)	24.57%	(10.8)
Fluid/Electrolyte disorder	29.64%	(8.8)	32.97%	(8.3)
Fracture	16.21%	(7.4)	13.84%	(6.6)
Genitourinary condition	33.20%	(8.3)	40.29%	(8.3)
Uncomplicated hypertension	37.60%	(8.7)	43.20%	(8.6)
Musculoskeletal disease	27.93%	(9.6)	30.20%	(9.6)
Nervous system disorder	25.27%	(7.8)	25.93%	(7.6)
Respiratory disease	25.53%	(7.6)	28.39%	(7.5)
Skin disorder	12.44%	(6.3)	13.08%	(6.1)
Valvular disease	7.76%	(5.0)	9.06%	(5.4)
LOS of qualifying hospital stay (days)	9.25	(2.7)	8.60	(2.3)
Staffing levels				
RN hours/resident-day	0.59	(0.8)	0.44	(0.6)
Licensed nursing hours/resident-day	1.75	(1.2)	1.68	(0.9)
CNA hours/resident-day	2.30	(0.8)	2.47	(0.8)
Facility characteristics				
Northeast	20.73%	-	18.84%	-
Midwest	30.62%	-	32.07%	-
South	32.22%	-	34.48%	-
West	15.44%	-	14.61%	-
Hospital-based	13.34%	-	7.83%	-
Freestanding	86.66%	-	92.17%	-
Urban	71.15%	-	68.43%	-
Rural	28.85%	-	31.57%	-
For-profit	67.01%	-	68.38%	-
Non-profit	28.38%	-	27.25%	-
Government	4.62%	-	4.37%	-

[1] Sample for 2000 is facilities with non-missing data in 2000 for rehospitalization in 100 days and community discharge in 30 days

[2] Sample for 2005 is facilities with non-missing data in 2005 for rehospitalization in 100 days and community discharge in 30 days

[3] Values are interpreted as “Mean % of residents in the facility with this condition,” or as “Mean average resident value in the facility for this item”

[4] Higher values indicate better status

[5] Lower values indicate better status

Table 3: Community discharge within 100 days regression model series

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2005 only
1	Time	.0000	-	.00203	-	-
2	Time, presence at 2000 only and 2005 only indicators	.0359	-	.03191	.15263	-.08136
3	Time, presence at 2000 only and 2005 only indicators, case mix	.5951	-	.00897	.05380	-.03832
4	Step 3 and hospital LOS	.5957	.00204	.01053	.05449	-.03783
5	Step 3 and region (Northeast, Midwest, South)	.6099	-.05707 NE -.08192 MW -.04264 S	.00453	.05234	-.03800
6	Step 3 and hospital-based	.6247	.14016	.01034	.01266	-.03936
7	Step 3 and ownership (for-profit, government)	.5962	-.01533 profit -.00113 gov	.00860	.05145	-.03872
8	Step 3 and urban	.5933	.03144	.01234	.05369	-.03572
9	Step 3 and RN hours/resident-day	.6106	.05655	.01625	.00904	-.04049
10	Step 3 and licensed nursing hours/resident-day	.6154	.03895	.01032	.00251	-.04249
11	Step 3 and CNA hours/resident-day	.5885	.01443	.00710	.04224	-.04232
12	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.6177	.02258 RN .02682 lic nsg .00670 CNA	.01147	.00085	-.04215

Table 4A: Community discharge within 100 days final regression model without staffing variables

Variable	Coefficient	Standardized Coefficient[1]	p-value
Intercept	0.35594	-	<0.0001
Time	0.01235	-	<0.0001
2000 only indicator	0.01261	-	0.0013
2005 only indicator	-0.03606	-	<0.0001
DNR orders	-0.11378	-0.12520	<0.0001
Barthel Index score (0-90)[2]	0.00127	0.05600	<0.0001
Cognitive Performance Scale score (0-6)[3]	-0.04651	-0.16351	<0.0001
Bowel incontinence scale (1-4) (MDS item H1a)[3]	-0.05042	-0.16567	<0.0001
Indwelling catheter (MDS item H3d)	0.04671	0.02628	<0.0001
Feeding tube (MDS item K5b)	-0.03837	-0.01482	0.0081
Parenteral/IV feedings (MDS item K5a)	0.07836	0.05691	<0.0001
Rehabilitation RUG	0.15242	0.12670	<0.0001
Community discharge comorbidity index (-3.5 to 3.3)	0.09959	0.06029	<0.0001
Cardiac arrhythmia	0.06041	0.02292	<0.0001
COPD	-0.05750	-0.02171	<0.0001
Dementia	-0.21549	-0.11663	<0.0001
Fracture	0.11616	0.04046	<0.0001
Genitourinary condition	-0.11997	-0.05340	<0.0001
Uncomplicated hypertension	0.08837	0.03938	<0.0001
Musculoskeletal disease	0.17378	0.08274	<0.0001
Skin disorder	-0.07622	-0.02323	<0.0001
Valvular disease	0.15037	0.03897	<0.0001
LOS of qualifying hospital stay (days)	0.00218	0.02679	<0.0001
Northeast	-0.05336	-	<0.0001
Midwest	-0.07449	-	<0.0001
South	-0.03941	-	<0.0001
Hospital-based	0.14356	-	<0.0001
For-profit	0.00707	-	0.0003
Government	-0.00935	-	0.0174
Urban	0.03036	-	<0.0001

Model adjusted $R^2 = 0.6430$

[1] Coefficient of the standardized (mean=0, variance=1) variable

[2] Higher values indicate better status

[3] Lower values indicate better status

Table 4B: Community discharge within 100 days final regression model with staffing variables

Variable	Coefficient	Standardized Coefficient[1]	p-value
Intercept	0.32575	-	<0.0001
Time	0.01117	-	<0.0001
2000 only indicator	-0.00547	-	0.2157
2005 only indicator	-0.03950	-	<0.0001
DNR orders	-0.10348	-0.11576	<0.0001
Barthel Index score (0-90)[2]	0.00089	0.03961	<0.0001
Cognitive Performance Scale score (0-6)[3]	-0.04306	-0.15353	<0.0001
Bowel incontinence scale (1-4) (MDS item H1a)[3]	-0.05286	-0.17684	<0.0001
Indwelling catheter (MDS item H3d)	0.02982	0.01696	<0.0001
Feeding tube (MDS item K5b)	-0.04752	-0.01874	0.0015
Parenteral/IV feedings (MDS item K5a)	0.06759	0.05037	<0.0001
Rehabilitation RUG	0.14012	0.11883	<0.0001
Community discharge comorbidity index (-3.5 to 3.3)	0.08571	0.05271	<0.0001
Cardiac arrhythmia	0.05381	0.02089	<0.0001
COPD	-0.06565	-0.02529	<0.0001
Dementia	-0.21623	-0.11903	<0.0001
Fracture	0.14418	0.05083	<0.0001
Genitourinary condition	-0.10895	-0.04912	<0.0001
Uncomplicated hypertension	0.09733	0.04411	<0.0001
Musculoskeletal disease	0.15574	0.07496	<0.0001
Skin disorder	-0.07266	-0.02262	<0.0001
Valvular disease	0.14054	0.03735	<0.0001
LOS of qualifying hospital stay (days)	0.00198	0.02475	<0.0001
Northeast	-0.05403	-	<0.0001
Midwest	-0.07379	-	<0.0001
South	-0.04382	-	<0.0001
Hospital-based	0.09219	-	<0.0001
For-profit	0.01111	-	<0.0001
Government	-0.00697	-	0.0914
Urban	0.02528	-	<0.0001
Licensed nursing hours/resident-day	0.02499	0.13402	<0.0001
CNA hours/resident-day	0.00382	0.01560	0.0002

Model adjusted $R^2 = 0.6404$

[1] Coefficient of the standardized (mean=0, variance=1) variable

[2] Higher values indicate better status

[3] Lower values indicate better status

Table 5: Rehospitalization within 100 days regression model series

Step	Variables in model	Model adj R^2	Coefficient of tested variable	Coefficient of time	Coefficient of 2000 only	Coefficient of 2005 only
1	Time	.0413	-	.03326	-	-
2	Time, presence at 2000 only and 2005 only indicators	.0532	-	.03068	-.04201	-.00851
3	Time, presence at 2000 only and 2005 only indicators, case mix	.4983	-	.02136	-.02704	-.00328
4	Step 3 and hospital LOS	.4983	-.00020	.02122	-.02711	-.00333
5	Step 3 and region (Northeast, Midwest, South)	.5072	.02655 NE .02176 MW .01739 S	.02218	-.02598	-.00287
6	Step 3 and hospital-based	.5286	-.05587	.02088	-.00999	-.00317
7	Step 3 and ownership (for-profit, government)	.5132	.02093 profit -.01160 gov	.02228	-.02297	-.00267
8	Step 3 and urban	.4983	-.00165	.02128	-.02704	-.00340
9	Step 3 and RN hours/resident-day	.5109	-.01823	.01980	-.01255	-.00427
10	Step 3 and licensed nursing hours/resident-day	.5121	-.01189	.02169	-.01109	-.00365
11	Step 3 and CNA hours/resident-day	.4960	-.00369	.02225	-.02377	-.00358
12	Step 3 and RN hours/resident-day, licensed nursing hours/resident-day, CNA hours/resident-day	.5138	-.00906 RN -.00725 lic nsg -.00129 CNA	.02105	-.01029	-.00387

Table 6A: Rehospitalization within 100 days final regression model without staffing variables

Variable	Coefficient	Standardized Coefficient[1]	p-value
Intercept	0.02955	-	0.0121
Time	0.02207	-	<0.0001
2000 only indicator	-0.00934	-	<0.0001
2005 only indicator	-0.00254	-	0.0428
Age (years)	0.00031	0.01435	0.0114
DNR orders	-0.03458	-0.09487	<0.0001
Do not hospitalize orders	-0.02503	-0.01675	0.0001
Barthel Index (0-90)[2]	-0.00113	-0.12414	<0.0001
Cognitive Performance Scale (0-6)[3]	-0.00247	-0.02163	0.0034
Bowel incontinence scale (1-4) (MDS item H1a)[3]	0.01416	0.11601	<0.0001
Feeding tube (MDS item K5b)	0.17463	0.16795	<0.0001
Pressure ulcer (MDS item M2a, any stage)	0.04936	0.06714	<0.0001
Rehabilitation RUG	0.02897	0.06007	<0.0001
Rehospitalization case mix index (-3.3 to 3.1)	0.16595	0.16640	<0.0001
COPD	0.02471	0.02327	<0.0001
Fluid/Electrolyte disorder	0.07270	0.07748	<0.0001
Fracture	-0.10326	-0.08967	<0.0001
Genitourinary condition	0.03593	0.03988	<0.0001
Musculoskeletal disease	-0.04184	-0.04967	<0.0001
Nervous system disorder	-0.04726	-0.04489	<0.0001
Skin disorder	0.06382	0.04856	<0.0001
Valvular disease	-0.05868	-0.03794	<0.0001
LOS of qualifying hospital stay (days)	-	-	-
Northeast	0.02671	-	<0.0001
Midwest	0.02191	-	<0.0001
South	0.01819	-	<0.0001
Hospital-based	-0.04579	-	<0.0001
For-profit	0.01423	-	<0.0001
Government	-0.00673	-	0.0002
Urban	-0.00243	-	0.004

Model adjusted $R^2 = 0.5419$

[1] Coefficient of the standardized (mean=0, variance=1) variable

[2] Higher values indicate better status

[3] Lower values indicate better status

Table 6B: Rehospitalization within 100 days final regression model with staffing variables

Variable	Coefficient	Standardized Coefficient[1]	p-value
Intercept	0.02971	-	0.0174
Time	0.02272	-	<0.0001
2000 only indicator	-0.00592	-	0.0035
2005 only indicator	-0.00301	-	0.0194
Age (years)	0.00043	0.02001	0.0008
DNR orders	-0.03629	-0.09939	<0.0001
Do not hospitalize orders	-0.02539	-0.01692	0.0002
Barthel Index (0-90)[2]	-0.00109	-0.11928	<0.0001
Cognitive Performance Scale (0-6)[3]	-0.00274	-0.02393	0.0019
Bowel incontinence scale (1-4) (MDS item H1a)[3]	0.01309	0.10720	<0.0001
Feeding tube (MDS item K5b)	0.17969	0.17335	<0.0001
Pressure ulcer (MDS item M2a, any stage)	0.05564	0.07580	<0.0001
Rehabilitation RUG	0.02848	0.05917	<0.0001
Rehospitalization case mix index (-3.3 to 3.1)	0.16476	0.16532	<0.0001
COPD	0.03142	0.02963	<0.0001
Fluid/Electrolyte disorder	0.07361	0.07846	<0.0001
Fracture	-0.10899	-0.09406	<0.0001
Genitourinary condition	0.03423	0.03779	<0.0001
Musculoskeletal disease	-0.04136	-0.04875	<0.0001
Nervous system disorder	-0.04929	-0.04689	<0.0001
Skin disorder	0.06240	0.04757	<0.0001
Valvular disease	-0.05963	-0.03879	<0.0001
LOS of qualifying hospital stay (days)	-0.00029	-0.00886	0.0497
Northeast	0.02599	-	<0.0001
Midwest	0.02226	-	<0.0001
South	0.01921	-	<0.0001
Hospital-based	-0.03366	-	<0.0001
For-profit	0.01369	-	<0.0001
Government	-0.00849	-	<0.0001
Urban	-	-	-
Licensed nursing hours/resident-day	-0.00531	-0.06972	<0.0001

Model adjusted $R^2 = 0.5375$

[1] Coefficient of the standardized (mean=0, variance=1) variable

[2] Higher values indicate better status

[3] Lower values indicate better status